

# METAL FOIL CHIP FIXED RESISTOR

## - CML SERIES -

### FEATURES

- The highest power is up to 2W
- The lowest TCR is 25 ppm/°C (see 2512 rating for TCR)
- Current detecting resistors for power supply, etc
- Superior mechanical and frequency characteristics
- Compliant with RoHS directive
- Halogen free requirement

### APPLICATIONS

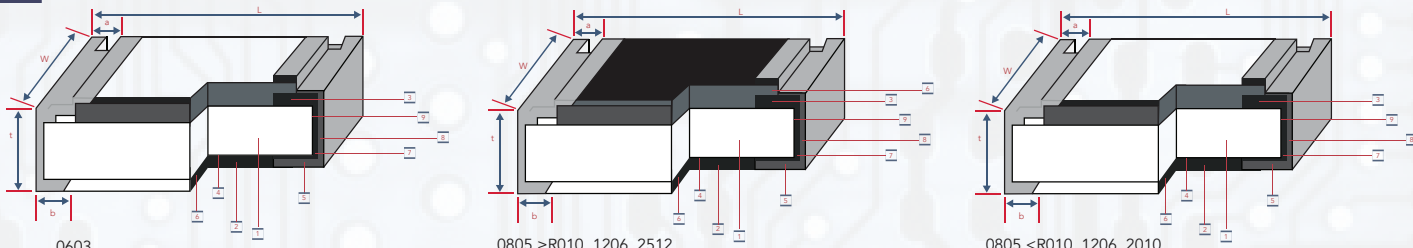
- Switching Power Supply, Over Current Protection, Voltage Regulation Module (VRM), DC-DC Converter, Charger, Portable Devices, Etc.



### PART NUMBERING

CML	K	2512	C	R010	F	T
PRODUCT CODEP	OWER RATING SERIES CODE	TYPE CODE	TCR CODE	RESISTANCE VALUE CODE	RESISTANCE TOLERANCE CODE	PACKAGING STYLE CODE
Metal Foil Chip Fixed Resistor	G - 1/2W H - 3/4 W J - 1W K - 2W	0603 - 1608 0805 - 2012 1206 - 3216 2010 - 5025 2512 - 6432	B - ± 25 C - ±50 K - ±100 W - ±200	Units: Ω Decimal point should be expressed by 'R'  Units: Ω Decimal point should be expressed by 'M' R005 - 0.005Ω R100 - 0.100Ω R047 - 0.047Ω 6M50 - 6.50MΩ	F - ±1% G - ±2% J - ±5%	T - Tap & Reel C - Case

### CONSTRUCTION

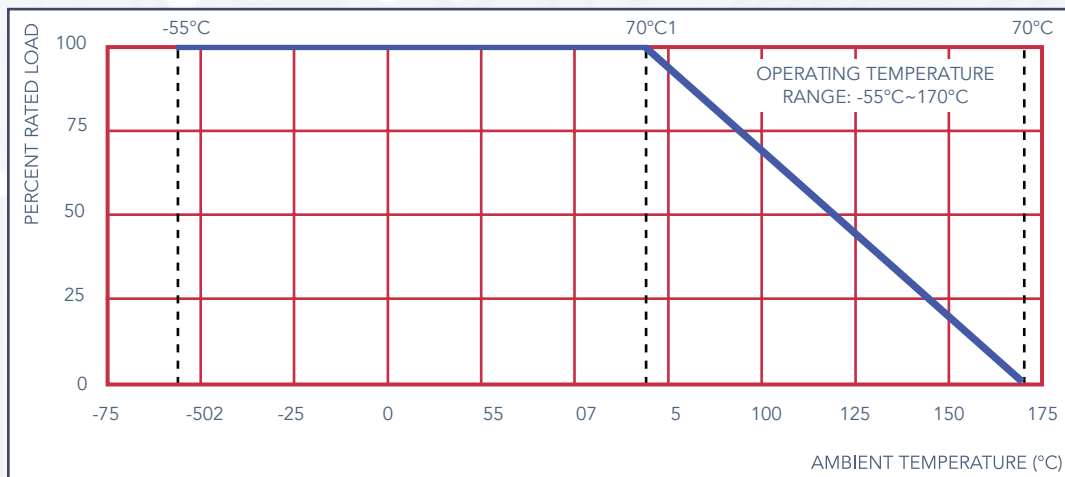


- 1 Ceramic Substrate
- 2 Alloy Plate
- 3 Top Electrode
- 4 Primary Overcoat
- 5 Barrier Layer (Ni)
- 6 External Electrode (Sn)
- 7 Edge Electrode
- 8 Barrier Layer
- 9 External Electrode

### DIMENSIONS

TYPE	M Ω	L (MM)	W (MM)	t (MM)	a (MM)	b (MM)
0603	≥R005	1.6±0.20	0.80±0.20	0.70±0.15	0.35±0.25	0.35±0.20
0805	R003~R004	2.00±0.20	1.25±0.20	0.70±0.15	0.40±0.25	0.70±0.30
	≥R005					0.40±0.30
1206	R003~R004	3.20±0.20	1.60±0.20	0.75±0.15	0.50±0.30	0.90±0.30
	≥R005					0.50±0.30
2010	R003	5.00±0.20	2.50±0.20	0.75±0.20	0.60±0.30	1.60±0.30
	R004~R005					1.30±0.30
	>R005					0.80±0.30
2512	R002	6.40±0.20	3.20±0.20	0.75±0.20	0.90±0.30	2.30±0.30
	R003					1.90±0.30
	R004					1.70±0.30
	R005~R006					1.20±0.30
	R007					1.10±0.30
	>R007					0.90±0.30

## DERIVATIVE CURVE



NOTE: For resistors operated in ambient over 70°C, rated load (rated power) shall be derated in accordance with the above figure.

## RATINGS

TYPE	RATING POWER AT 70°C (W)	LIMITING ELEMENT CURRENT (A)	MAX. OVERLOAD CURRENT (A)	RESISTANCE RANGE CURRENT (A)
0603	1/2	10	22.4	$0.005\Omega \leq R \leq 0.030\Omega$
0805	1/2, 3/4	15.8	35.4	$0.003\Omega \leq R \leq 0.047\Omega$
1206	1/2, 1	18.3	40.8	$0.003\Omega \leq R \leq 0.068\Omega$
2010	1	18.3	40.8	$0.003\Omega \leq R \leq 0.100\Omega$
2512	2	31.6	63.3	$0.002\Omega \leq R \leq 0.100\Omega$
	1	3.20	7.10	$0.100\Omega \leq R \leq 0.200\Omega$

NOTE:

1. Current of DC or AC RMS Value
2.  $I = \sqrt{P/R}$   
 $I = \sqrt{P/R}$  or limiting element current whichever is lower  
 I - Rated current (A)  
 P - Rated power (W)  
 R - Normal Resistance ( $\Omega$ )

TYPE	RESISTANCE RANGE	T.C.R. (PPM/°C) RESISTANCE TOLERANCE		
		±1%	±2%	±5%
0603	$0.005\Omega \leq R \leq 0.010\Omega$	±200	±200	±200
	$0.010\Omega \leq R \leq 0.030\Omega$	±100	±100	±100
0805	$0.003\Omega \leq R \leq 0.010\Omega$	±100	±100	±100
	$0.010\Omega \leq R \leq 0.047\Omega$	±50	±50	±50
1206	$0.003\Omega \leq R \leq 0.010\Omega$	±100	±100	±100
	$0.010\Omega \leq R \leq 0.068\Omega$	±50	±50	±50
2010	$0.003\Omega \leq R \leq 0.010\Omega$	±100	±100	±100
	$0.010\Omega \leq R \leq 0.100\Omega$	±50	±50	±50
2512	0.002 $\Omega$	±200	±200	±200
	$0.003\Omega \leq R \leq 0.010\Omega$	±100	±100	±100
	$0.010\Omega \leq R \leq 0.200\Omega$	±25   ±50	±25   ±50	±25   ±50

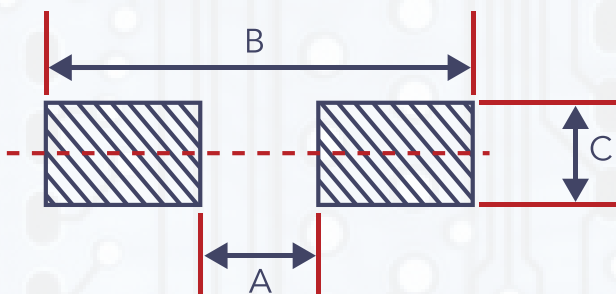
NOTE: The chip resistor with resistance value below 0.010 $\Omega$  and TCR  $\pm 50$  ppm/°C can be customized



## CHARACTERISTICS

ITEM	SPECIFICATIONS	TEST METHODS (IEC60115-1)
SOLDERABILITY	95% Cover Min	IEC 60115-1 4.17 Lead-free solder bath at 245°C ± 5°C for 3s±0.3s
RESISTANCE TO SOLDERING HEAT	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.18 Lead-free solder bath at 270°C ± 5°C for 10s±1s
SUBSTRATE BENDING TEST	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.33 Bending distance: 0603, 0805, 1206, 3mm; 2010, 2512: 2mm Duration: 60s ± 5s.
T.C.R.	Within specified T.C.R.	IEC 60115-1 4.8 +20°C/+125°C/+20°C
RAPID CHANGE OF TEMPERATURE	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.19 -55°C (30 min) ~ normal temperature (5 min) ~ 125°C (30 min) 100 cycles
SHORT TIME OVERLOAD	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.13 1/2W, 3/4W, 1W: 5 X Rated Power, for 5s. 2W: 4 X Rated Power, for 5 s.
DAMP HEAT STEADY STATE	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.24 40°C ± 2°C, 93% ± 3% RH, 1000h, rated current or limiting element current whichever is lower for 1.5h ON/0.5h OFF.
ENDURANCE AT 70°C	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.25.1 70°C ± 2°C, 1000h, rated current or limiting element current whichever is lower for 1.5h ON/0.5h OFF.
ENDURANCE AT UPPER CATEGORY TEMPERATURE	No mechanical damage $\Delta R \leq \pm 1.0\%$	IEC 60115-1 4.25.3 +170°C ± 2°C, 1000h
INSULATION RESISTANCE	1000M $\Omega$ Min	IEC 60115-1 4.6 Apply DC 100V ± 15V between substrate and terminations for 1min, then check insulation resistance
VOLTAGE PROOF	No breakdown or flashover	IEC 60115-1 4.7 Apply max. overload voltage of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60s±5s
COMPONENT SOLVENT RESISTANCE	No mechanical damage $\Delta R \leq \pm 1.0\%R$	IEC 60115-1 4.29 Iso-propyl alcohol (IPA), 23°C ± 5°C, 10h

## RECOMMENDED SOLDERING PAD SIZE



TYPE	m $\Omega$	A	B	C
0603	R005~R030	0.6	2.8	1.0
	R003~R004	0.5	3.2	1.4
0805	R005~R047	0.8		
	1206	R003~R004	0.8	4.4
R005~R068		1.8		
2010	R003~R009	1.6	6.3	2.9
	R010~R100	2.7		
2512	R002~R004	1.0	8.0	3.4
	R005~R200	3.8		